



City of Pittsburgh

Smart Streetlights

RFI No. 2017-0001

April 10, 2017 5:00pm

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April 6, 2017

Thoryn Simpson
Senior Procurement Analyst
Office of Management and Budget
City-County Building, Room 502
Pittsburgh, PA 15219

Thank you for offering ePlus Technology, inc. (“ePlus”) the opportunity to respond to your RFI for **Smart Streetlights (RFI No. 2017-0001)**. We have reviewed the City of Pittsburgh’s stated goals and requirements contained in your RFI. We are confident that our solution provides a proven approach – combining appropriate practices, technology, and intellectual capital to meet and exceed your process improvement and cost savings objectives.

The following response and attachments will clearly demonstrate how ePlus will assist you in achieving your goals. Our proposal contains all the supporting information you should need.

ePlus is submitting its proposal on the understanding and with the expectation that the City of Pittsburgh and ePlus Technology, inc. will have the opportunity to work together to enter into a mutually acceptable contract for the products and services described in an agreed upon statement of work.

The experience that ePlus will demonstrate throughout the process will highlight our strengths and expertise in this arena. We look forward to the opportunity in the very near future to personally present our solution.

Thank you for your consideration.

Sincerely,

A handwritten signature in black ink, appearing to read 'Elaine Marion', with a long horizontal line extending to the right.

Elaine Marion
Chief Financial Officer

Required language:

- Smart Streetlights
- ePlus Technology, inc.; 13595 Dulles Technology Drive, Herndon, VA 20171
- Mark Carretta, Account Executive
Phone: 412-258-1697 / FAX: 703-984-8600
Email: mcarretta@eplus.com
- ePlus hereby acknowledges that all responses may be considered public information in accordance with the Commonwealth of Pennsylvania Right to Know Laws as described in Section 5 of this document.
- No individual, or if any principal or employee of our firm, has a relationship or knowledge of, or contact with any official or employee of the City.



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ePlus as a Reseller

ePlus is fully committed to holding the discount structure contained in our bid response for the life of the contract but is subject to future potential manufacturer changes in overall pricing models to its resellers. ePlus would require the opportunity to amend its committed discount in order to maintain an equivalent level of margin to be able to continue the supply. ePlus will provide the documentation to support manufacturer modification that supports a change any pricing structure. It is possible that changes can also occur in other manufacturer terms such as changes in warranty terms that are outside of ePlus' control and we reserve the right to modify this schedule from time to time to accommodate these potential changes by providing written notice. If changes of this nature are not something for which you would consider an exception, ePlus would merely require the opportunity to vacate the particular award(s) effected by the manufacturer's changes which are outside of our control.

NO INFORMATION PROPOSED HEREIN SHALL BE CONSIDERED A "FIRM AND FINAL OFFER."

Executive Summary

ePlus understands that the City of Pittsburgh is seeking a Smart Streetlights Solution and an ongoing trusted partnership.

We are perfectly positioned to work with the City of Pittsburgh on the Smart Streetlights Solution. Some of the qualifications that distinguish us from our competition are:

- ePlus has knowledgeable staff that have a longstanding working relationship with the City of Pittsburgh and their Innovation & Performance staff.
- ePlus understands the City of Pittsburgh's current environment and has implemented the technologies that will be used on the backend of the Smart Streetlights RFI.
- ePlus currently has a Master Financing Agreement in place which will help augment the cost of a Smart Streetlights Solution.
- Our team is dedicated to serving State/Local Government Entities.
- We have experience working on major large scale environments on both Domestic and International levels.
- We keep abreast of the top manufacturers' programs for government clients.
- ePlus professionals are trained in the latest networking methodologies and technologies, specifically those requested by the City of Pittsburgh.
- ePlus has a proven track record with our services delivery model of plan, build, optimize, and support to provide turnkey solutions on major projects for our customers.
- We will supply references for similar projects to those requested.



Our staff, matched with the highest partnerships with the world's top IT vendors and manufacturers, allows ePlus to offer a variety of comprehensive, competitively priced technology solutions to our customers.

Project Overview

Describe the solution you are proposing and its objectives. Provide designs that help us understand how it would work with the existing streetlight poles and other infrastructure on our streets. Detail the scale, scope and stage of your idea. Has it been deployed elsewhere? If so include detailed materials describing that deployment. If not, provide as much technical details as you can. If the idea is in beta or more nascent, please indicate this; ideas at all stages are of interest to the City.

ePlus Response: ePlus proposes a smart city lighting solution that will meet the current and future needs of the City of Pittsburgh.

Before providing details on the solution ePlus proposes, ePlus would like to take this opportunity to highlight the importance of a prescriptive approach to implementing a smart city solution. ePlus leverages a three-step process to implement smart city solutions:

1. ePlus Smart City Ideation Workshop
 - a. A multi-day assessment-like workshop with line of business, OT, and IT leadership to identify and solidify an idea, or concept, that will determine a clear business outcome and ensure multiple “layers of value”
2. ePlus Smart City Rapid Prototype Engagement
 - a. Translate idea/concept from workshop into a functional prototype (proof of concept) to validate business outcome and multiple layers of value
3. ePlus Smart City Solution Deployment Engagement
 - a. Transition prototype from proof of concept scale to large scale deployment across multiple agencies/departments/etc.

ePlus highly recommends leveraging the ideation/assessment process prior to investing in a smart city solution of any scale. The ideation workshop will identify and quantify a clear business outcome as well as the multiple layers of value. Please note the concept of “layers of value” is defined in the closing section of ePlus response. Additionally, it will ensure that cross team/department value, and dependencies, are identified and ensure any potential challenges, and how to address them, are clear in advance.

ePlus proposes a smart city solution that will leverage existing infrastructure, where appropriate, and include new infrastructure that supports interfacing for a wide range of “things” (lighting, sensors, cameras), wired and wireless connectivity, third-party (existing and new) systems, and analytics such as artificial intelligence (AI) and machine learning (ML).

The primary objective of the solution will be to meet the immediate needs of the City of Pittsburgh which includes “smart” LED lighting that will introduce cost savings and support multiple use cases. Additionally, the solution will be enabled to support use cases external to the lighting solution.

The solution high level design will be as follows:

- Existing high-pressure sodium HID luminaries (or similar) will be replaced with a high efficiency LED luminaries
- At the streetlight pole an edge device will be placed that will enable “smart” control of the LED and enable other wired and wireless services via the edge device as a smart hub

- A Centralized application and data processing system (platform) will be deployed, on premise (data center) or in the cloud (SaaS), to process and perform analytics against gathered data as well as provide a user interface dashboard with metrics

LED Luminaries

The existing high-pressure sodium HID luminaries, that typically deliver yellow light with less focus and wide spread coverage, will be replaced with LED luminaries that deliver whiter (more natural) light with more direct, focused coverage. The cost savings will be substantial, as the City of Pittsburgh is already aware based on the results of the LED pilot deployment.

“Smart City” Edge Device

At each streetlight pole a “smart” edge device will be deployed to enable intelligence, control, and visibility never possible before with traditional streetlights. The edge device will function as the distributed hub of the solution. As such, it will support a variety of connectivity mechanisms without the need for complex and costly wired infrastructure traditionally required. It will also support a wireless (multiple modes) mesh model for relevant areas extending outside of the city. The edge device will support termination for serial and low voltage for use with localized sensors and other objects. The edge device will also support a wide range of connectivity including Ethernet, for both local objects (including PoE support for endpoints such as surveillance cameras) and upstream connectivity, Wi-Fi, cellular (3G/4G/LTE), LPWAN/LoRaWAN (low power WAN, unlicensed spectrum), and LTE-M/NB-IOT (narrow band cellular, licensed). The wide variety of connectivity options supported by the solution will ensure the City of Pittsburgh is able to support any smart city and/or IOT initiative in the future.

Centralized Application and Data Processing System (Platform)

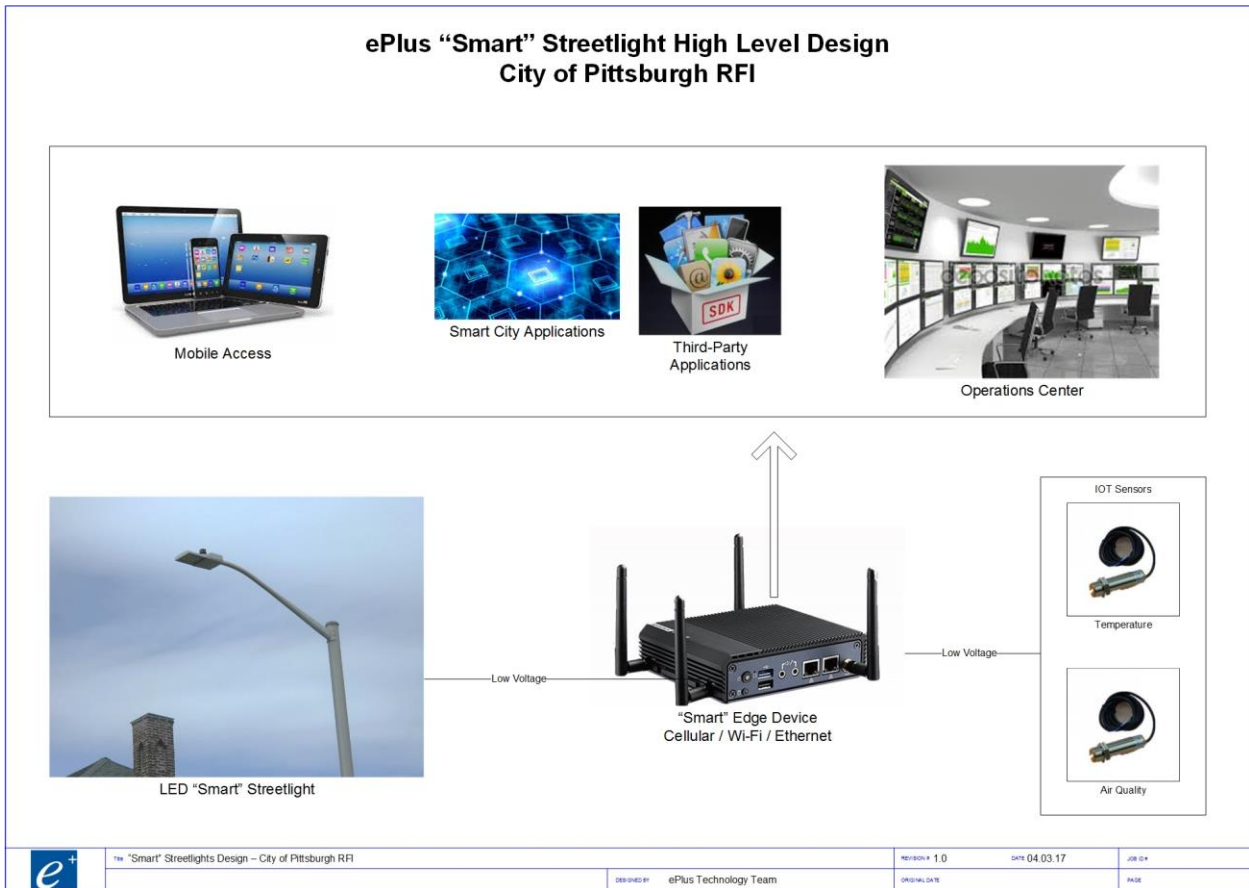
The solution will include a single centralized application and data processing system – often referred to as a platform. Similar to the edge device in the field, this platform will be the hub for all internal and external data as well as third party applications and integration. It will provide a number of key functions:

- Monitoring
 - Dashboards for viewing real-time information such as lighting efficiency
- Management
 - Dashboards for viewing real-time information such as system(s) health
- Alerting and Reporting
 - Dashboards for viewing information such as real-time alerting and historical reporting
- Integrations
 - Integration with existing and new third-party systems for event and data correlation for advanced analytics
 - Support for open standards ensuring compatibility with a wide range of applications

ePlus would like to very briefly highlight smarty city use cases that can be integrated into the proposed solution:

- City-wide Wi-Fi hotspots
- Smart parking
- Traffic monitoring
- Safety and security awareness
- Smart waste management

The following is a high-level diagram of the integration from streetlight to edge device and application:



Deployment Plan

Please let us know how specifically this project will deploy across Pittsburgh's infrastructure. Would you recommend a pilot deployment before undertaking the full project? If so, describe the scale of the pilot and parts of the city you feel would make the best testbed for your idea, and why.

ePlus Response:

ePlus leverages a standard PMO methodology for all IT, OT, and other projects of a technical/engineering nature. These principles include:

- Providing a detailed project plan and approach
- Define detailed goals and objectives
- Define detailed scope of work
- Clearly identify deliverables
- Clearly identify assumptions and constraints
- Provide a structured quality management approach
- Provide a structured project management approach

ePlus leverages PMBOK principles for all IT, OT, and other projects of a technical/engineering nature. These principles include:

- Initiate
- Plan
- Execute
- Monitor/Control
- Close



ePlus will begin the deployment by first reviewing the initial pilot deployment that is in place today. The goals will be to understand what worked well and what didn't, lessons learned. It will be key to understand how that pilot environment will interact/integrate with this much larger (scope) deployment. Following that, ePlus will perform the following (not limited to) steps:

1. Coordinate a project kickoff meeting
2. Review scope of engagement and identify task/responsibility owners
3. Coordinate site visits/walkthroughs where appropriate
4. Identify pilot locations for the first phase of the deployment
5. Deploy pilot locations
6. Test and validate pilot locations against required use cases and city scenarios
7. Complete remaining locations based on a phased approach
8. Document all efforts and solution elements
9. Provide administrator and operator training where appropriate
10. Coordinate a project closeout meeting

ePlus will select a subset of the streetlight locations, typically between 5-10 locations, for a first phase "pilot" implementation as part of the larger deployment for the entire project. The pilot locations will be selected based on identified use cases and operational scenarios. For example:

1. Residential area
2. Community area such as a park
3. Main thoroughfares such as freeways or major roads

Prior to the pilot all "backend" solution components, such as management and monitoring centralized applications, will be put in place. The pilot locations will be reviewed in detail to ensure that all viable use cases are covered in a small scale. Pre-deployment, deployment, and post-deployment activities will be monitored closely to ensure success of future phases. Results from the pilot will be applied to future phases. And, where appropriate, adjustments will be made to the project schedule and deployment plan.

Technical Specifications

Provide as much technical detail for the project as you can, including its power, sensor and communications technologies. Any solution will be selected based on a technical evaluation of not just its Smart City aspects but also its traditional technical aspects, such as the color temperature, photometrics and other details of the LED luminaires. (Note that should we proceed through an RFP process, all devices will be tested in the real world.) Describe your plans for data ownership, transmission, security, and privacy. Open standards and industry best-practices will be applied in considering ideas.

ePlus Response:

LED Luminaries

LED lighting specifications vary by make and model. As the City of Pittsburgh has already deployed Cree, here are several sample specifications:

Make/Model	CREE XSP1	CREE LEDWAY	CREE EDGE	CREE VG
Use Case	Street lighting	Street lighting	Park/Recreation	Exterior Site
Warranty	10 years	10 years	10 years	10 years
Lumen Output	1759-14408	24000	1754-38841	3710-3870
Optic	Multiple	Multiple	Multiple	Multiple



Wattage	53-139	35-267	25-263	50
Color Temp	40K or 50K	Multiple	Multiple	Multiple
Voltage	UL 120-277V	UL 120-277V UH 347-480V	UL 120-277V UH 347-480V	UL 120-277V
Photocell Compatible	Yes	Yes	Yes	N/A

Please note that individual LED selection (or recommendation) will be provided outside of this response.

“Smart City” Edge Device

Edge device specifications vary by make and model. Below is a sample specification for an edge device that would be compatible with a “smart city” solution:

Make/Model	N/A
Use Case	Field edge device
Form Factor	Compact/Rugged
Serial	RS232/RS485
Security	IPsec/3DES/AES/SHA
Wireless	802.11 a/b/g/n
Ethernet	Multiple GigE
Power over Ethernet	Yes
Cellular	Yes, including LTE
Power Requirement (V)	Nominal 12/24 DC Min/Max 9-32 DC In Max/Min 7.8A/2.2A

Centralized Application and Data Processing System (Platform)

Centralized application and data processing systems (platforms) requirements vary based on a number of factors including redundancy requirements, solution scale, and features enabled. Most applications, systems, and platforms can be deployed into an existing data center virtualization environment or cloud introducing no power consumption or related operational overhead.

Data Ownership

ePlus understands that Smart City solutions require multiple levels of data ownership and involve multiple agencies. ePlus builds solutions that include methodologies tailored to least privilege access. Data classification and efforts to ensure secured access in realms of multi-tenancy are paramount to solutions that span internal, external, and partner data sources. ePlus will leverage security features built into technology components of the proposed solution and provide auxiliary controls via technology and process where appropriate. Additionally, ePlus understands that data ownership and security overall is not solely addressed by software or products but by policy, procedure, and training. ePlus adheres to and works to exceed baseline standards found in NIST, ISO27000, and other frameworks and control documents when designing data protection programs. Further information on ePlus security practices around smart cities and IOT can be provided separately from this response.

Transmission

ePlus understands that Smart City solutions require multiple forms of transmission. For one, this includes both wired and wireless connectivity. Both wired and wireless connectivity will be leveraged – each where appropriate based cost, bandwidth required, and other factors. IOT elements of Smart City solutions also have power/battery consumption factors. These will be considered as well to ensure low

power solutions are selected where appropriate to ensure proper operation along with minimal maintenance. The below table highlights a sampling of the transmission parameters related to communication mechanisms available to support smart city and IOT solutions:

Name of Standard	Wi-Fi	SigFox	LPWAN/LoRaWAN	LTE-M/NB-IOT
Frequency Band	2.4/3.6/4.9/5/5.9 GHz	868/902 MHz	433/780/868/915 MHz	Cellular
Channel Width	20/40/80/160MHz	Ultra-narrow band	64x125 kHz 8x125kHz	1.4MHz
Range	Multiple	30-50km (rural) 3-10km (urban) 1000km LoS	15km (rural) 2-5km (urban)	2.5-5km
Topology	Multiple	Star	Star on Star	Star
Roaming	Yes	Yes	Yes	Yes
Governing Body	Yes	Yes	Yes	Yes

Security

ePlus ensures security is an integral component of every IT and OT solution. Many IT products have security capabilities built-in whereas many OT products do not. Regardless, ePlus evaluates all elements of a smart city solution to ensure that its security stack meets industry standards, compliance requirements, and the requirements identified by the city. Security technologies for smart city solutions typically include authentication, encryption, data at rest, data in motion, and physical security – to name a few. ePlus approaches security controls with a program to prevent, detect, and respond to cyber threats. Integration with existing security operations controls and processes will be addressed to ensure that the sensitive nature of smart city components, infrastructure and resident data achieves the proper risk assignment in the overall structure of your cyber security program. ePlus also ensures current security resources are advised, trained, and measured to enable proper operation, automation, and auditability of all security components and their related processes.

Privacy

ePlus understands that privacy is critical for all organizations, institutions, municipalities, and individuals – certainly significant for cities. Smart city solutions introduce privacy implications – not just for the institution but for the individual/resident as well. ePlus addresses privacy in a similar way to security overall. A combination of IT software along with clearly written/identified policies, procedures, and training based on information gathered from appropriate resources from the city.

Operational Considerations

Provide detailed information about the useful life of the component technologies included in your proposed project, along with specific information about how and where any of its technologies have been field tested. The City will need to fully understand the additional investment required to maintain technology over the life of the project, as well as the proposed maintenance model.

ePlus Response: ePlus fully understands the lifecycle of IT and OT technology. IT components of the solution such as edge devices and centralized application and data processing systems, addressed later in this response, have an extensive lifecycle. Edge devices, for example, can operate in the field for well over ten (10) years in a wide variety of environment conditions. Centralized application and data processing systems (platforms) are often virtualized (software only) and are not impacted by physical



hardware lifecycle. Both edge device and centralized application and data processing systems require very minimal maintenance via software updates (patches) that deliver new features/functionality. OT components of the solution vary significantly – this is the case for any solution due to the inherent nature of the underlying components that are consistent across the industry. For example, surveillance cameras can operate for many years in outdoor environment conditions whereas sensor lifecycles vary significantly. Temperature sensors have a longer lifecycle than humidity, moisture, and air quality sensors due to calibration and other factors.

Will the City or partner vendors maintain components in the field?

ePlus Response: ePlus can support both options. Where appropriate, the City may choose to maintain some, or all, of the solution components. Where appropriate, ePlus can manage some, or all, of the solution components. This includes remote monitoring, moves/adds/changes, and dispatch for repair or replacement.

What failure rate would be expected and what costs incurred by the City for replacement components?

ePlus Response: Failure rate of infrastructure devices is typically measured by the manufacturer in mean time before failure (MTBF). The median MTBF for most infrastructure devices, those with little or no moving parts, is 500,000 hours (57+ years). The median MTBF for infrastructure devices with moving parts is 300,000 hours (34+ years). Production reliability and availability are typically a percentage of MTBF based on factors such as environmental considerations and operator parameters. Even where that MTBF is 25% accurate the minimum failure time period would be 87,600 hours (10+ years). Current LEDs have a lifetime of 50,000 to 100,000 hours (11+ years). Lifetime for LEDs is different than MTBF for non-LED bulbs. The lifetime mentioned is related to L70 rating which refers to when the LED emits only 70% of its original light. LEDs can continue to operate for years beyond that L70 lifetime rating. Replacement costs would vary based on a per solution component basis. For components where the manufacturer warranty is current and applicable, only labor costs may apply. For components where the manufacturer warranty is not applicable, material and labor costs may apply. ePlus can provide reactive and proactive management and replacement if that is of interest to the City. Additionally, an “as a Service” consumption model for the solution is possible that will provide consistent and reliable cost structure.

Business Model

Describe any business model or revenue sharing you imagine supporting your idea. None is required, outside of a basic discussion of the feasibility of your idea based the revenue streams identified above, but the City is interested in hearing any such ideas.

ePlus Response: Technology Financing from ePlus is a simple but powerful business resource that significantly reduces the time and capital requirements typically associated with leasing and IT procurement. Our process-oriented business solution provides compliance control and maximum savings at each stage in the equipment lifecycle. We contemplate the needs of an entire project, including labor hours, training, maintenance, application software, and hardware infrastructure rolled out over time. Whether you are looking for a simple payment plan or an end-to-end asset management IT source, ePlus can tailor an IT program to suit the City of Pittsburgh’s specific needs. ePlus currently has a Master Financing Agreement in place with the City of Pittsburgh for some of their IT purchasing needs.

Evaluation

Please evaluate of your idea's strengths and weaknesses, with hard data if available. Describe how you would analyze, and recommend we analyze, any data produced by your idea in order to gauge the effectiveness and civic value of the project.

ePlus Response: ePlus considers a number of factors when evaluating smart city solutions, technologies, and approaches. From an IOT perspective of smart cities there are things, platform, data, and analytics. The “thing” is more than just selection of a sensor or monitor. Selection of a thing requires balancing an appropriate power source (high power draw means shorter run time) based on power consumption factors such as compute cycles and communication mechanisms (Wi-Fi consumes much more power than other options). Additionally, it is important to determine what level of intelligence at or “near” the thing prior to reaching the cloud (or data center). The platform selection is also critical as it is the singular destination for all smart city and IOT things and its flexibility, or lack thereof, can significantly impact the use cases (and layers of value) and integrations available. Data is a byproduct of every smart city and IOT solution. However, how that data is managed (and filtered) is key. For example, a connected car can generate 2TB of raw data per hour. How is that data processed? How is only the relevant data extracted for proper analysis and use? Although the City of Pittsburgh will not necessarily be in the business of monitoring connected cars, this simple example demonstrates how important it is to understand the data implications and select the appropriate technologies and solutions to support the required use cases. Lastly, analytics (in some cases part of the platform selection) are key to unlocking they hidden value inside the raw data extracted from a wide variety of things, sensors, and even third-party systems. Analytics, such as artificial intelligence (AI) and machine learning (ML) allow identification of patterns and anomalies to enable new levels of awareness and action.

Based on the above, ePlus would recommend not evaluating a “smart city” solution based on a single technology or architecture alone. Any given “smart city” and/or IOT solution will require a wide range of IT technology, OT technology, and a wide range of experience. That said, the two most critical technology components of a smart city solution are the edge device, which enables the resources in the field, and the platform, which brings all the disparate data and systems together to make sense of it all and deliver meaningful, actionable information.

Aside from the technology, and more importantly, is the process and prescriptive approach to identifying, designing, implementing, and supporting smart city and IOT solutions. A smart city and/or IOT solution is highly dependent on an architecture, one that comprises many technologies. But, before the architecture can even begin to materialize, a business outcome must be identified. That outcome will often have multiple layers of value. A few examples of layers of value are cost, experience, and platform. Cost value, for example, can be seen operationally in the use of lower power consumption LED luminaries. However, that is just the beginning of the cost savings possible with a smart city solution. Cost savings could be possible for residents via “pay per use” models in the long term. Experience value is another key element of a successful outcome, one that can only be successfully identified before a technology architecture is established. Experience could impact city officials, workers, contracts, and residents in a variety of ways. Platform value is delivered directly by the use of technology. An example could be a mobile application that guides residents, or visitors, to the nearest available parking space in a densely populated area. Even platform value requires clear business outcome goals identified well in advance. ePlus highly recommends the City of Pittsburgh select best of breed technology – but just as important select an integrator based on their overall approach to smart cities, IOT, and digital transformation – that approach should be one focused on outcomes and value.